



Environment

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# Draft Post-RAC Work Plan

Granville Solvents Site  
Granville, Licking County, Ohio

USEPA ID: OHD004495412

December 13, 2011

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## 1.0 Introduction

This document contains a proposed scope of work to be performed at the Granville Solvents Site (Village of Granville, Licking County, Ohio) in response to the United States Environmental Protection Agency (EPA) Review Comments dated April 6, 2011 and a meeting with Region 5 on June 29 regarding the 2010 Draft Removal Action Completion (RAC) Report dated July 30, 2010. The RAC Report was submitted to the EPA in order to apply for a Notice of Completion (NOC) regarding removal actions conducted at the site between 1995 and 2005 as required by the Administrative Order on Consent (AOC) issued by the EPA on September 7, 1994. This document is considered to be a modification to the original work plan in accordance with Section XVII of the AOC and after implementation may allow for submittal of a modified RAC Report.

The EPA requested performance of the following tasks as outlined in Section 6 of the RAC Report EPA Review Comments:

- a. Perform vertical aquifer sampling from the top to the bottom of the aquifer at a location halfway between the MW-07 and MW-08 clusters.
- b. Collect groundwater levels on a 20-minute frequency in several monitoring wells and determine if trends in water levels can be attributed to the start or termination of pumping from the municipal wells, and which pumping wells it can be related to.
- c. Collect a (groundwater) sample from GSSEW-1.
- d. Continue annual (groundwater) monitoring for a minimum of two years (semi-annually through 2012), and until it is determined that monitoring is no longer necessary.

Tasks (c) and (d) will be conducted during the semi-annual groundwater sampling events in accordance with the post-shutdown monitoring plan as summarized in Section 1.2 of this work plan. The overall objective of this work plan is to define the proposed scope of work to address Tasks (a) and (b) and to also propose a scope of work to address other concerns at the Site. The other concerns consist of the discrepancy between groundwater flow direction and volatile organic compound (VOC) plume migration direction, potential presence of 1,4-dioxane and occurrence of natural attenuation processes. Tasks have been developed to evaluate the other concerns and consist of sampling and testing site media to evaluate groundwater quality south of the site, sampling and testing for 1,4-dioxane and sampling associated with potential biotic and/or abiotic natural attenuation processes occurring within subsurface media at the Site.

Included in this section of the work plan is a summary of the Site background, semi-annual sampling methods and proposed scope of work.

### 1.1 Background

From 1953 to 1986 various solvents were handled at the small, 1.5-acre, triangular-shaped parcel with the property boundary shown as the fenced area on Figure 1. The site is situated about 1,000 feet east of the Village of Granville's municipal well field (Granville Well-field), on the northern edge of what appears to be a typical Ohio buried-valley aquifer. The buried valley aquifer system typically consists of approximately 150 ft of channel fill on top of bedrock, with the channel fill consisting of sand and gravel. The bedrock consists of inter-bedded near-horizontal layers of sandstone, siltstone and shale with minor conglomerate units. Cross section lines are shown on Figure 1 with geologic cross-sections provided on Figures 2 and 3.

In 1991, all solvent materials were removed from the Site and in 1994 the Granville PRP Group (the Group) entered into an agreement with EPA to perform soil and groundwater remedial actions at the Site. In 1994, two groundwater extraction wells (GSSEW-01 and GSSEW-02) were installed to provide capture and containment of impacted groundwater. The system operated for about 10 years from 1995 to 2005 resulting in a total of about 900 million gallons extracted, treated and discharged to the near-by Raccoon Creek. In addition, between 2001 and 2005, source area soil and groundwater was also remediated via a soil vapor extraction (SVE) /air sparge system at the areas shown on Figures 1 to 3. A general chronology of site activities is provided below:

- 1990 to 1994 – Site discovery and installation of Ohio EPA monitoring wells;
- 1994 – AOC entered;
- 1995 – Work Plan developed and two extraction wells installed/operated;
- 1995 to 1996 – GSS monitoring wells installed;
- 1998 – Fate and transport modeling conducted;
- 1999 – EE/CA conducted to evaluate alternatives for further remediation;
- 2001 – SVE/sparge system selected and installed at source area;
- 2004 – Remedial post shut-down/post-monitoring plan submitted to the EPA;
- 2005 – Both the groundwater pump and treat and SVE/sparge remediation systems were discontinued and post-monitoring began which consisted of semi-annual sampling of select wells.
- 2010 – RAC report requesting an NOC for the AOC;
- 2011 – The EPA requested submittal of a modified work plan to (1) address the potential vertical migration of the plume, (2) determine groundwater flow direction from the Site.

The Granville Well-field (public water system) typically pumps about 500 to 700 gallons per minute (gpm) continuously by alternating use of supply wells PW-2, PW-3A and PW-4. To date, VOCs have not been detected in the supply wells PW-2 to PW-4. Supply well PW-2 is included in Ohio EPA's ambient groundwater monitoring program and is occasionally tested for VOCs with no detections to date. Groundwater within the property boundary currently exhibits very low levels of dissolved-phase PCE, TCE and DCE with occasional TCA detected during the latest semi-annual groundwater monitoring event conducted in November 2011.

## 1.2 Semi-annual Sampling Events

The EPA also requested continuation of the semi-annual groundwater sampling events through calendar year 2012 as noted in Section 1.0 of this work plan. Semi-annual sampling events were conducted in May and November of 2011 and two semi-annual sampling events will be conducted in 2012. The semi-annual sampling events will be conducted in general accordance with the scope outlined in Section 3.1.2 of the USEPA-approved "Proposal to Suspend Groundwater and Soil Treatment Systems Operations and Commence Post-Shutdown Groundwater Monitoring at the Granville Solvents Site", dated August 2004. The post shutdown monitoring plan requires testing of groundwater for VOCs at the following monitoring wells:

- MW-02D
- MW-04D
- MW-06
- MW-07D
- MW-08

- MW-P1
- GSSMW-15
- GSSEW-01

Sampling and testing at GSSMW-08 and GSSMW-09 will also be conducted. In addition, gauging of all 29 project area monitoring wells will be conducted to provide a potentiometric surface map of the project area during the sampling event. One annual report will be prepared containing information for each sampling event consisting of a detailed description of methods used and summary of results. The report will include a summary of purge data, detailed potentiometric surface map, summary table of groundwater results, VOC concentration maps and VOC concentration trend charts for appropriate monitoring wells.

### **1.3 Scope of Work**

The proposed activities described in this work plan include the following:

- Vertical Groundwater Profiling;
- Pump Response Testing;
- South Area Sampling;
- Attenuation Sampling; and
- Testing for 1,4-dioxane.

Field work will be conducted in accordance with a site-specific Health and Safety Plan (HASP) which will cover site field sampling activities. All personnel involved with the fieldwork, including subcontractors, will be required to review the HASP prior to commencing the field activities and will comply with all health and safety requirements.

A utility survey will be conducted prior to any vertical profiles and monitoring well installation to avoid existing subsurface structures. The survey will include:

- Public and private utility locating/marketing services
- Ground Penetrating Radar (Geophysical Survey Systems SIR 3000 (or equivalent))

Sample locations will be located at a proper distance (greater than 3 feet) from all identified utilities.

## **2.0 Vertical Profile Groundwater Sampling**

In order to obtain information on VOC concentrations with depth between the site and the Granville Well-field, vertical profiling of groundwater quality will be conducted between MW-07 and MW-08 at the location shown on Figure 1 as VG-1. Vertical profiling will be conducted using direct-push drilling equipment equipped with the Geoprobe® Screen Point 16 (SP-16) groundwater sampler to selectively collect discrete groundwater samples for aquifer profiling. A description of the groundwater sampling device and standard operating procedure (SOP) is provided in Appendix A.

The direct push drill rig will have the capability to advance tooling to 120 feet bgs. This depth extends below the elevation of the deepest well screen of the Granville Well-field supply wells. Groundwater samples will be collected vertically using a 51.5 inch long stainless steel tooling assembly capable of exposing a maximum of 41-inches of screen to the formation. The sampling tool will be extended to the maximum depth and samples obtained from the bottom upwards at approximate 10-foot intervals to the top of the groundwater table about 20 to 25 ft below grade. The midpoint of the profiler screen will be placed near the midpoint of each 10-foot depth interval. Tubing utilized for sample collection will be placed at the midpoint of the SP-16 sample screen. The groundwater will be conveyed to the surface using a small-diameter bladder pump or peristaltic pump. Pumping at each vertical location will continue until the groundwater becomes clear or when the field parameters described below stabilize.

Field parameters utilized to monitor groundwater stability will consist of pH, temperature, conductivity, dissolved oxygen (DO) and oxidation-reduction potential (ORP). The groundwater samples will be packaged and delivered to Test America for analysis of VOCs using USEPA SW-846 Method 524.2. The laboratory will report only those VOCs previously detected at the Site. A total of approximately 10 groundwater samples are anticipated, in addition to quality assurance/quality control (QA/QC) samples. QA/QC samples will include field duplicates, equipment blanks, and MS/MSD samples at the frequency and in general accordance with procedures outlined in the Removal Action Groundwater Monitoring Program Plan (Revised July 25, 1995).

The location of each vertical profile location will be surveyed to the same datum and coordinate system as the other wells in the project area. The open probe hole can be filled with grout as the sampling equipment is withdrawn as described in the SOP.

### **3.0 Pump Response Test**

A pump response test will be conducted to determine if trends in monitoring well water levels can be attributed to the start or termination of pumping wells from the Granville Well-field and which pumping wells closest and furthest from the Site have the most affect on the monitoring well water levels. This will be achieved by collecting pumping data and groundwater levels from both the pumping wells and selected monitoring wells as described below.

The drinking water supply for the Village of Granville is obtained from the Granville Well-field which is just west of the treatment plant at 445 Palmer Lane. Currently, three wells are in service and consist of pumping wells PW-2, PW-3A and PW-4 as shown on Figure 1. Any one of these three wells is capable of supplying the current daily demand for water of about 650,000 gallons and typically withdraws groundwater at a rate of about 500 to 700 gpm from a single well on a daily basis. The raw well water is pumped to an aerator, which releases trapped gases to the atmosphere and oxidizes iron dissolved in the water for removal by settling. The aerated water is mixed with a hydrated lime slurry, causing calcium and magnesium compounds to precipitate out of the water. After clarification, chlorine is added, pH is adjusted, sand bed filtering occurs and a fluoride compound is added prior to pumping to the distribution system.

Personnel from the Village of Granville Water Department have indicated that with at least several weeks notice, temporary adjusting of pumping well selection and rates can be conducted in order to accommodate the pump response testing. During pumping, drawdown is typically about 20 ft below the normal potentiometric surface and when the pump is turned off, this level typically rebounds to near the original potentiometric surface within minutes. Pumping rates are monitored continuously, while water levels in the pumping wells are typically not monitored, but can be surveyed manually using a standard water level meter. To maintain typical water supply levels, the longest time no wells can be pumping is about an hour.

To monitor the immediate and short-term changes in groundwater levels, pressure transducers will be placed in supply wells PW-2, PW-3A and PW-4 and monitoring wells, GSS-P3, MW-08, MW-02, and GSSMW-13. A down-hole pressure transducer utilizing an internal data logger will record continuous water level measurements from on-board sensors capable of reading water levels to an accuracy of 0.01 feet. The temporary pressure transducers will be installed and programmed the week before pump testing.

A one week long pump response test is proposed as outlined in the following schedule:

- Monday: Shut down all pumps for 1 hour. Activate PW-4 only ;
- Wednesday: Shut down all pumps for 1 hour. Activate PW-2 only; and
- Friday afternoon: Remove all temporary pressure transducers and down-load data.

The collected data on pumping rates and water levels will be plotted with time on a single graph to show which wells may be affected by the pumping activity.

## **4.0 South Area Sampling**

Sampling conducted in 2007 indicated that no VOCs were detected in surface water samples obtained from Raccoon Creek. Due to the absence of groundwater data south of monitoring well MW-2, it is possible that VOCs in groundwater may be migrating south toward Raccoon Creek as would be indicated by the potentiometric surface obtained from past monitoring activities. In order to investigate this possibility, a series of discrete groundwater samples will be collected along Raccoon Creek (shown as DG-1 through DG-4 on Figure 1). One discrete groundwater sample will be obtained at each location from the upper 10 ft of the water column using sampling techniques described in Section 2.0 of this work plan.

## 5.0 Attenuation Sampling/Testing

Degradation of VOCs does appear to be occurring via reductive dechlorination based on the presence of PCE daughter products. In addition, dispersion, volatilization and adsorption may also be contributing to a slow, but steady reduction in dissolved-phase mass. The VOC rebound observed in some of the monitoring wells since the extraction well shut-down occurred in 2005 appears to be limited to monitoring wells screened in the silty sand layer between the upper clay layer and sand and gravel aquifer.

During this Post-RAC Work Plan sampling event, preliminary natural attenuation evaluation will be conducted to assess the efficacy of biotic and abiotic processes which may be occurring in the silty sand layer and buried valley aquifer media. Regarding biotic processes, testing for total organic carbon (TOC) and dissolved methane, ethane and ethene (MEE), nitrate, sulfate and field-reduced iron is proposed. TOC tests will be conducted on several soil samples obtained from the silty sand layer at the location shown as NA-1 on Figure 1. MEE tests will be conducted on groundwater samples from impacted and non-impacted wells including MW-08, MW-05 and GSSMW-15, MW-02D, MW-P1 and MW-04D. Field parameters (pH, conductivity, temperature, oxidation-reduction potential and dissolved oxygen) will be collected as part of the sampling protocol and are useful in interpreting this data. Regarding abiotic processes, testing for total iron and manganese and extractable iron and manganese will be conducted on saturated soil samples obtained from the silty sand layer at sample location NA-1. Extractable analysis will be performed using the weak acid and strong acid methods to assess availability of iron and manganese as electron acceptors for reductive dechlorination of the low levels of dissolved-phase VOCs.

## 6.0 Testing For 1,4-Dioxane

Due to the historic presence of trichloroethane (TCA), monitoring well MW-6 will be sampled for 1,4-dioxane using USEPA SW-846 Method 8260B using selected ion monitoring (SIM) mode. This compound was mainly used historically as a stabilizer for TCA. The groundwater sample will be collected from MW-06 using purging methods outlined in the post shutdown monitoring plan.

## 7.0 Reporting

A Post-RAC Sampling Report will be prepared containing all results of the scope items outlined in this work plan. In addition, the 2011 Annual Groundwater Monitoring Report containing data



collected in May and November 2011 will be prepared and submitted. Information obtained from implementation of this work plan will be used to evaluate potential alternatives for developing closure criteria using the existing monitoring well system.

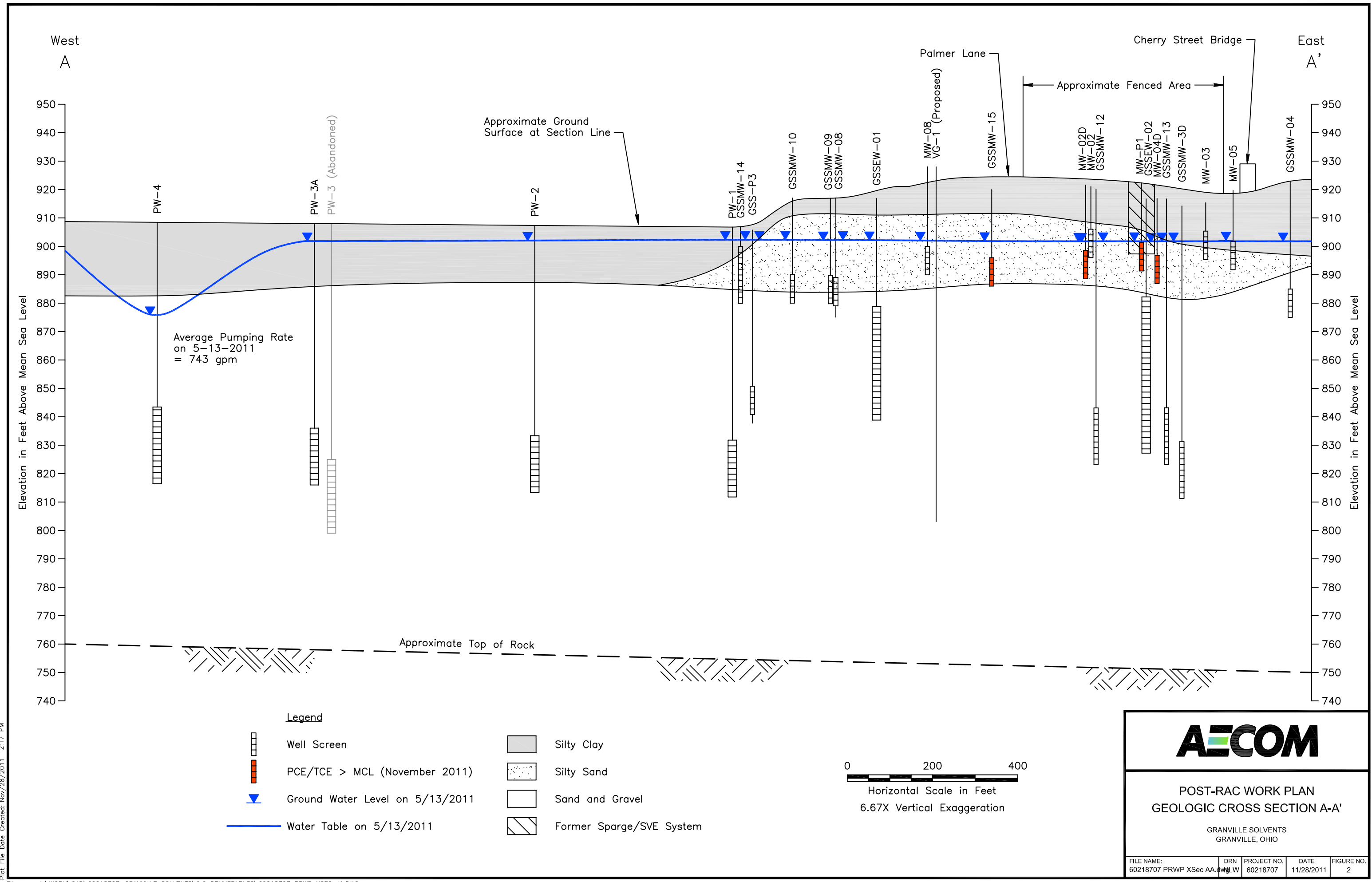
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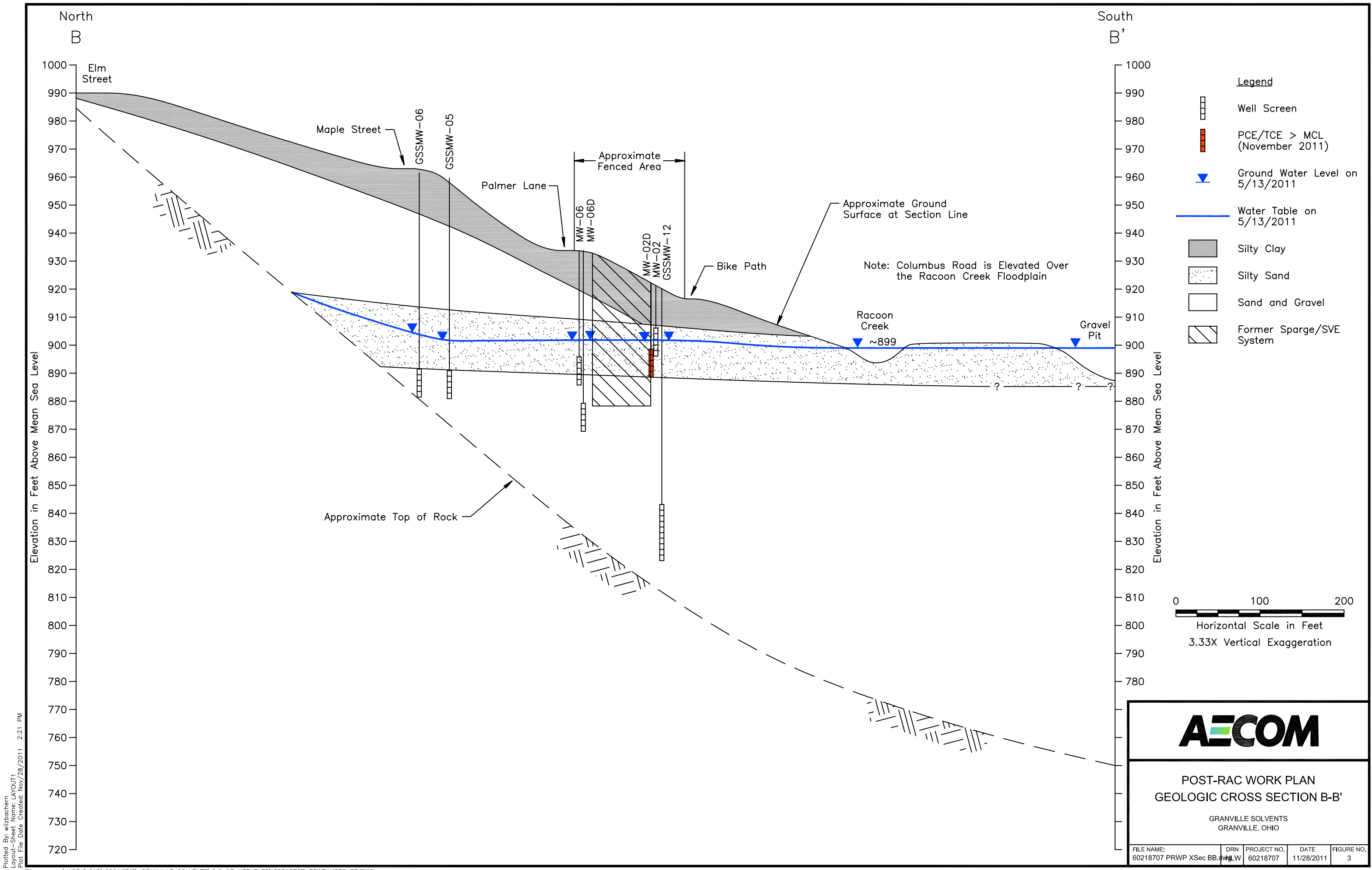
## Figures

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POST-RAC WORK PLAN  
GEOLOGIC CROSS SECTION B-B'

GRANVILLE SOLVENTS  
GRANVILLE, OHIO

FILE NAME: 60218707 PRWP XSec BB.dwg	DRN 60218707	PROJECT NO. 60218707	DATE 11/28/2011	FIGURE NO. 3
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## **Appendix A**

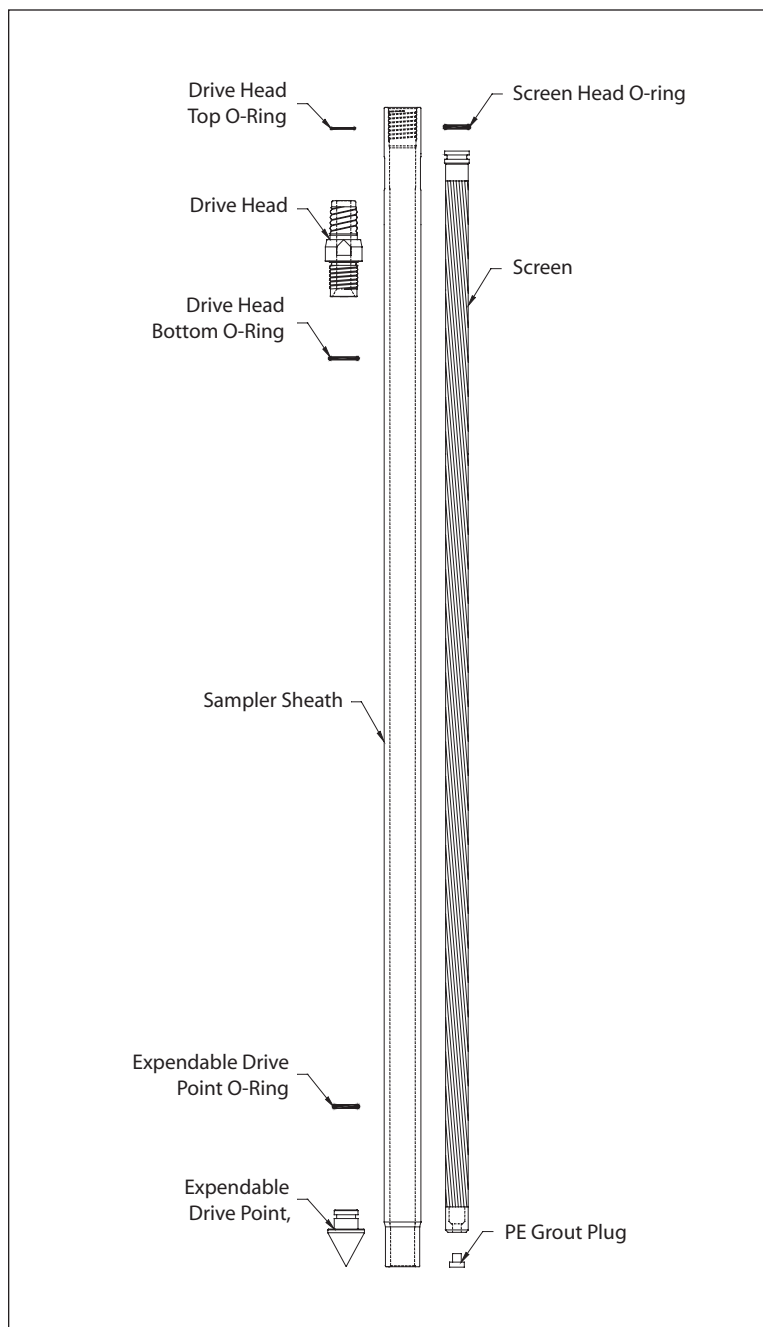
### **Geoprobe® Screen Point 16 Groundwater Sampler Standard Operating Procedure**

# GEOPROBE® SCREEN POINT 16 GROUNDWATER SAMPLER

## STANDARD OPERATING PROCEDURE

Technical Bulletin No. MK3142

PREPARED: November, 2006



## GEOPROBE® SCREEN POINT 16 GROUNDWATER SAMPLER PARTS



**Geoprobe® and Geoprobe Systems®, Macro-Core® and Direct Image® are  
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**Screen Point 16 Groundwater Sampler is manufactured  
under U.S. Patent 5,612,498**

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## 1.0 OBJECTIVE

The objective of this procedure is to drive a sealed stainless steel or PVC screen to depth, deploy the screen, obtain a representative water sample from the screen interval, and grout the probe hole during abandonment. The Screen Point 16 Groundwater Sampler enables the operator to conduct abandonment grouting that meets American Society for Testing and Materials (ASTM) Method D 5299 requirements for decommissioning wells and borings for environmental activities (ASTM 1993).

## 2.0 BACKGROUND

### 2.1 Definitions

**Geoprobe®:** A brand name of high quality, hydraulically powered machines that utilize both static force and percussion to advance sampling and logging tools into the subsurface. The Geoprobe® brand name refers to both machines and tools manufactured by Geoprobe Systems®, Salina, Kansas. Geoprobe® tools are used to perform soil core and soil gas sampling, groundwater sampling and monitoring, soil conductivity and contaminant logging, grouting, and materials injection.

**Screen Point 16 (SP16) Groundwater Sampler:** A direct push device consisting of a PVC or stainless steel screen that is driven to depth within a sealed, steel sheath and then deployed for the collection of representative groundwater samples. The assembled SP16 Sampler is approximately 51.5 inches (1308 mm) long with an OD of 1.625 inches (41 mm). Upon deployment, up to 41 inches (1041 mm) of screen can be exposed to the formation. The Screen Point 16 Groundwater Sampler is designed for use with 1.5-inch probe rods and machines equipped with the more powerful GH60 Hydraulic Hammer. Operators with GH40 Series hammers may choose to use this sampler in soils where driving is difficult.

**Rod Grip Pull System:** An attachment mounted on the hydraulic hammer of a direct push machine which makes it possible to retract the tool string with extension rods or flexible tubing protruding from the top of the probe rods. The Rod Grip Pull System includes a pull block with rod grip jaws that are bolted directly to the machine. A removable handle assembly straddles the tool string while hooking onto the pull block to effectively grip the probe rods as the hammer is raised. A separate handle assembly is required for each probe rod diameter.

### 2.2 Discussion

In this procedure, the assembled Screen Point 16 Groundwater Sampler (Fig. 2.1A) is threaded onto the leading end of a Geoprobe® probe rod and advanced into the subsurface with a Geoprobe® direct push machine. Additional probe rods are added incrementally and advanced until the desired sampling interval is reached. While the sampler is advanced to depth, O-ring seals at each rod joint, the drive head, and the expendable drive point provide a watertight system. This system eliminates the threat of formation fluids entering the screen before deployment and assures sample integrity.

Once at the desired sampling interval, extension rods are sent downhole until the leading rod contacts the bottom of the sampler screen. The tool string is then retracted approximately 44 inches (1118 mm) while the screen is held in place with the extension rods (Fig. 2.1B). As the tool string is retracted, the expendable point is released from the sampler sheath. The tool string and sheath may be retracted the full length of the screen or as little as a few inches if a small sampling interval is desired.

There are three types of screens that can be used in the Screen Point 16 Groundwater Sampler. Two of these, a stainless steel screen with a standard slot size of 0.004 inches (0.10 mm) and a PVC screen with a standard slot size of 0.010 inches (0.25 mm), are recovered with the tool string after sampling. The third screen is also manufactured from PVC with a standard slot size of 0.010 inches (0.25 mm), but is designed to be left downhole when sampling is complete. This disposable screen has an exposed screen length of approximately 43 inches (1092 mm). The two screens that are recovered with the sampler both have an exposed screen length of approximately 41 inches (1041 mm).

(continued on following page)

An O-ring on the head of the stainless steel screens maintains a seal at the top of the screen. As a result, any liquid entering the sampler during screen deployment must first pass through the screen. PVC screens do not require an O-ring because the tolerance between the screen head and sampler sheath is near that of the screen slot size.

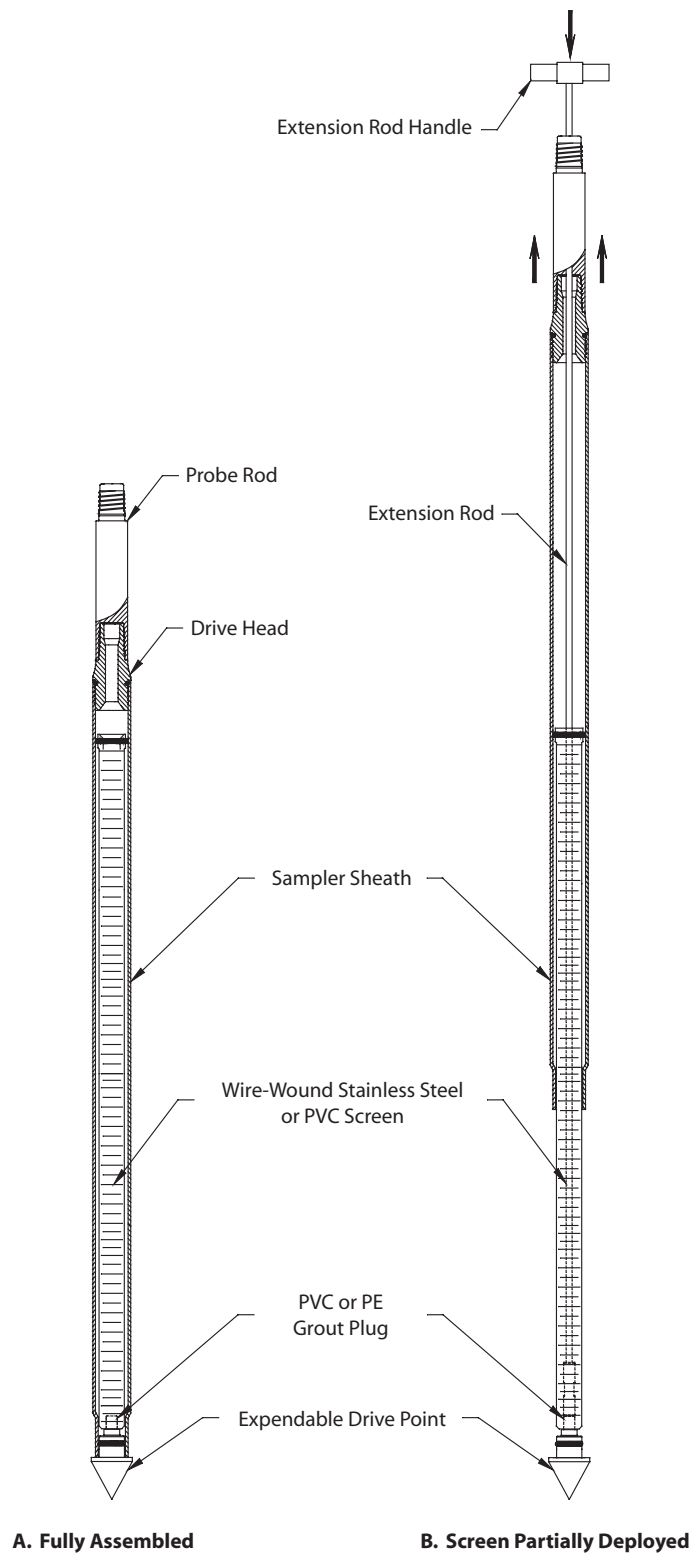
The screens are constructed such that flexible tubing, a mini-bailer, or a small-diameter bladder pump can be inserted into the screen cavity. This makes direct sampling possible from anywhere within the saturated zone. A removable plug in the lower end of the screens allows the user to grout as the sampler is extracted for further use.

Groundwater samples can be obtained in a number of ways. A common method utilizes polyethylene (TB25L) or Teflon® (TB25T) tubing and a Check Valve Assembly (GW4210). The check valve (with check ball) is attached to one end of the tubing and inserted down the casing until it is immersed in groundwater. Water is pumped through the tubing and to the ground surface by oscillating the tubing up and down.

An alternative means of collecting groundwater samples is to attach a peristaltic or vacuum pump to the tubing. This method is limited in that water can be pumped to the surface from a maximum depth of approximately 26 feet (8 m). Another technique for groundwater sampling is to use a stainless steel Mini-Bailer Assembly (GW41). The mini-bailer is lowered down the inside of the casing below the water level where it fills with water and is then retrieved from the casing.

The latest option for collecting groundwater from the SP16 sampler is to utilize a Geoprobe® MB470 Series Mechanical Bladder Pump (MBP)\*. The MBP may be used to meet requirements of the low-flow sampling protocol (Puls and Barcelona 1996, ASTM 2003). Through participation in a U.S. EPA Environmental Technology Verification study, it was confirmed that the MB470 can provide representative samples (EPA 2003).

*\*The Mechanical Bladder Pump is manufactured under U.S. Patent No. 6,877,965 issued April 12, 2005.*



**FIGURE 2.1**  
**Screen Point 16 Groundwater Sampler**

### 3.0 TOOLS AND EQUIPMENT

The following tools and equipment can be used to successfully recover representative groundwater samples with the Geoprobe® Screen Point 16 Groundwater Sampler. Refer to Figures 3.1 and 3.2 for identification of the specified parts. Tools are listed below for the most common SP16 / 1.5-inch probe rod configurations. Additional parts for optional rod sizes and accessories are listed in Appendix A.

<b>SP16 Sampler Parts</b>	<b>Part Number</b>
SP16 Sampler Sheath.....	15187
SP16 Drive Head, 0.5-inch bore, 1.5-inch rods* .....	18307
SP16 O-ring Service Kit, 1.5-inch rods ( <i>includes 4 each of the O-ring packets below</i> ) .....	15844
<i>O-rings for Top of SP16 Drive Head, 1.5-inch rods only (Pkt. of 25)</i> .....	15389
<i>O-rings for Bottom of SP16 Drive Head (Pkt. of 25)</i> .....	13196
<i>O-rings for GW1520 Screen Head (Pkt. of 25)</i> .....	GW1520R
<i>O-rings for SP16 Expendable Drive Point (Pkt. of 25)</i> .....	GW1555R
Screen, Wire-Wound Stainless Steel, 4-Slot* .....	GW1520
Grout Plugs, PE (Pkg. of 25) .....	GW1552K
Expendable Drive Points, steel, 1.625-inch OD (Pkg. of 25)* .....	GW1555K
Screen Point 16 Groundwater Sampler Kit, 1.5-inch Probe Rods ( <i>includes 1 each of:</i> 15187, 18307, 15844, GW1520, GW1535, GW1540, GW1555K, and GW1552K) .....	15770

<b>Probe Rods and Probe Rod Accessories</b>	<b>Part Number</b>
Drive Cap, 1.5-inch probe rods, threadless, (for GH60 Hammer) .....	12787
Pull Cap, 1.5-inch probe rods .....	15090
Probe Rod, 1.5-inch x 60-inch* .....	11121

<b>Extension Rods and Extension Rod Accessories</b>	<b>Part Number</b>
Screen Push Adapter.....	GW1535
Grout Plug Push Adapter.....	GW1540
Extension Rod, 60-inch* .....	10073
Extension Rod Coupler.....	AT68
Extension Rod Handle .....	AT69
Extension Rod Jig.....	AT690
Extension Rod Quick Link Coupler, pin.....	AT695
Extension Rod Quick Link Coupler, box.....	AT696

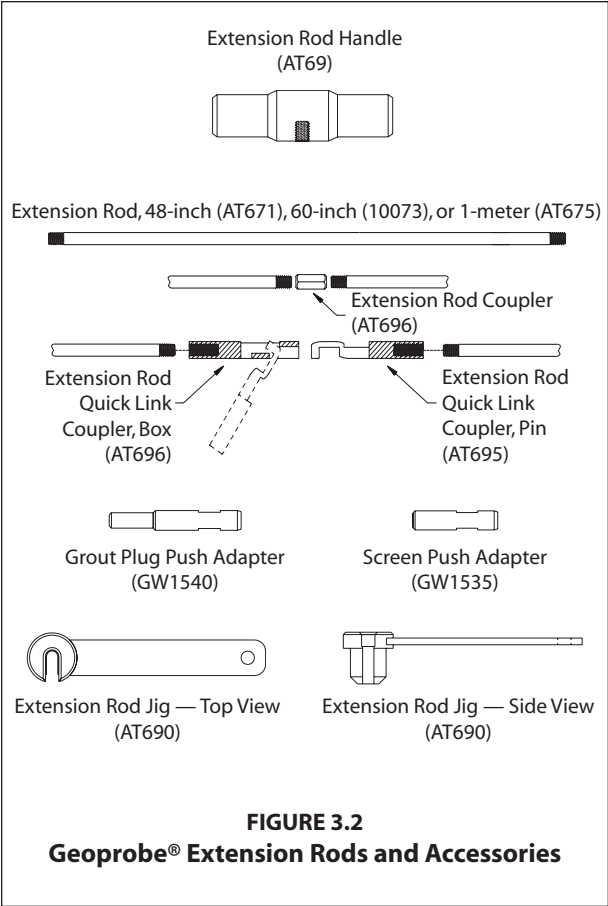
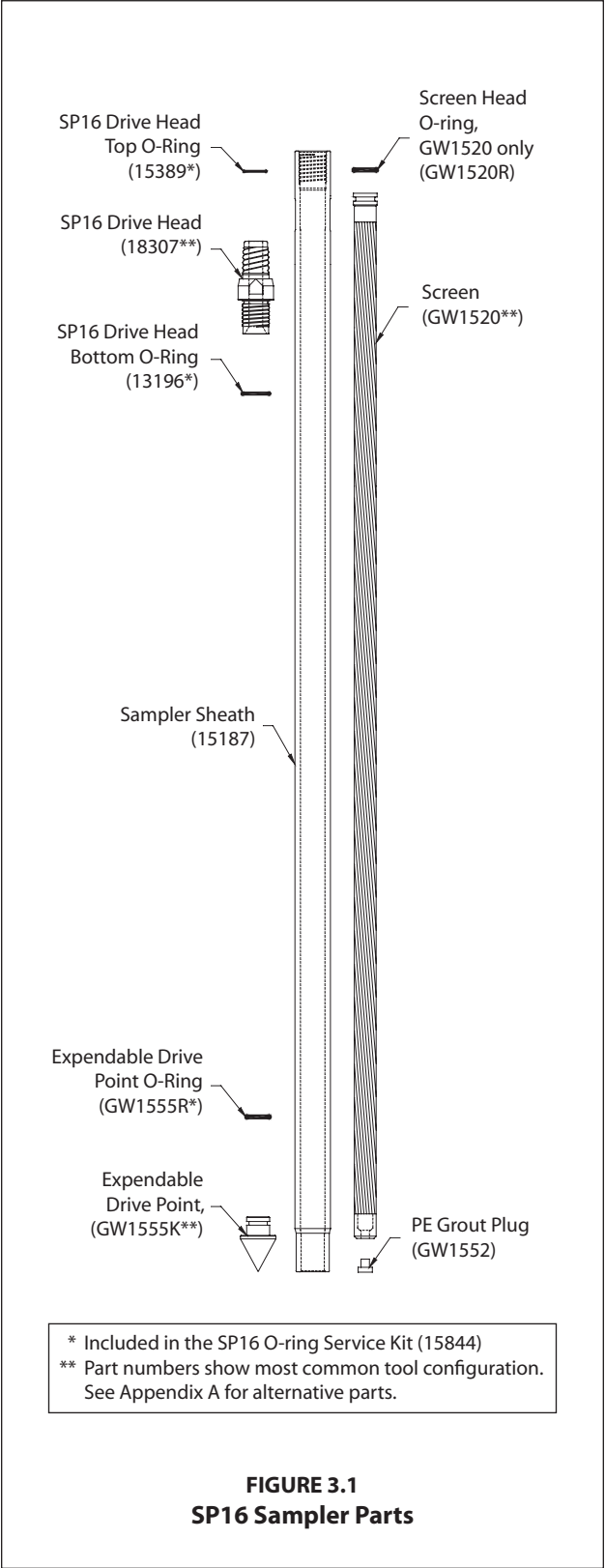
<b>Grout Accessories</b>	<b>Part Number</b>
Grout Nozzle, for 0.375-inch OD tubing .....	GW1545
High-Pressure Nylon Tubing, 0.375-inch OD / 0.25-inch ID, 100-ft. (30 m).....	11633
Grout Machine, self-contained* .....	GS1000
Grout System Accessories Package, 1.5-inch rods .....	GS1015

<b>Groundwater Purging and Sampling Accessories</b>	<b>Part Number</b>
Polyethylene Tubing, 0.375-inch OD, 500 ft. * .....	TB25L
Check Valve Assembly, 0.375-inch OD Tubing* .....	GW4210
Water Level Meter, 0.438-inch OD Probe, 100 ft. cable* .....	GW2000
Mechanical Bladder Pump** .....	MB470
Mini Bailer Assembly, stainless steel.....	GW41

<b>Additional Tools</b>	<b>Part Number</b>
Adjustable Wrench, 6.0-inch .....	FA200
Adjustable Wrench, 10.0-inch .....	FA201
Pipe Wrenches .....	NA

\* See Appendix A for additional tooling options.

\*\* Refer to the Standard Operating Procedure (SOP) for the Mechanical Bladder Pump (Technical Bulletin No. MK3013) for additional tooling needs.



## 4.0 OPERATION

### 4.1 Basic Operation

The SP16 sampler utilizes a stainless steel or PVC screen which is encased in an alloy steel sampler sheath. An expendable drive point is placed in the lower end of the sheath while a drive head is attached to the top. O-rings on the drive head and expendable point provide a watertight sheath which keeps contaminants out of the system as the sampler is driven to depth.

Once the sampling interval is reached, extension rods equipped with a screen push adapter are inserted down the ID of the probe rods. The tool string is then retracted up to 44 inches (1118 mm) while the screen is held in place with the extension rods. The system is now ready for groundwater sampling. When sampling is complete, a removable plug in the bottom of the screen allows for grouting below the sampler as the tool string is retrieved.

### 4.2 Sampler Options

The Screen Point 15 and Screen Point 16 Groundwater Samplers are nearly identical. Subtle differences in the design of the SP16 sampler make it more durable than the earlier SP15 system. Operators of GH60-equipped machines should always utilize SP16 tooling. Operators of machines equipped with GH40 Series hammers may also choose SP16 tooling when sampling in difficult probing conditions.

A 1.75-inch OD Expendable Drive Point (17066K) and Disposable PVC Screen (16089) provide two useful options for the SP16 sampler. The 1.75-inch drive point may be used when soil conditions make it difficult to remove the sampler after driving to depth. The disposable PVC screen may be left downhole after sampling (when regulations permit) to eliminate the time required for screen decontamination.

### 4.3 Decontamination

In order to collect representative groundwater samples, all sampler parts must be thoroughly cleaned before and after each use. Scrub all metal parts using a stiff brush and a nonphosphate soap solution. Steam cleaning may be substituted for hand-washing if available. Rinse with distilled water and allow to air-dry before assembly.

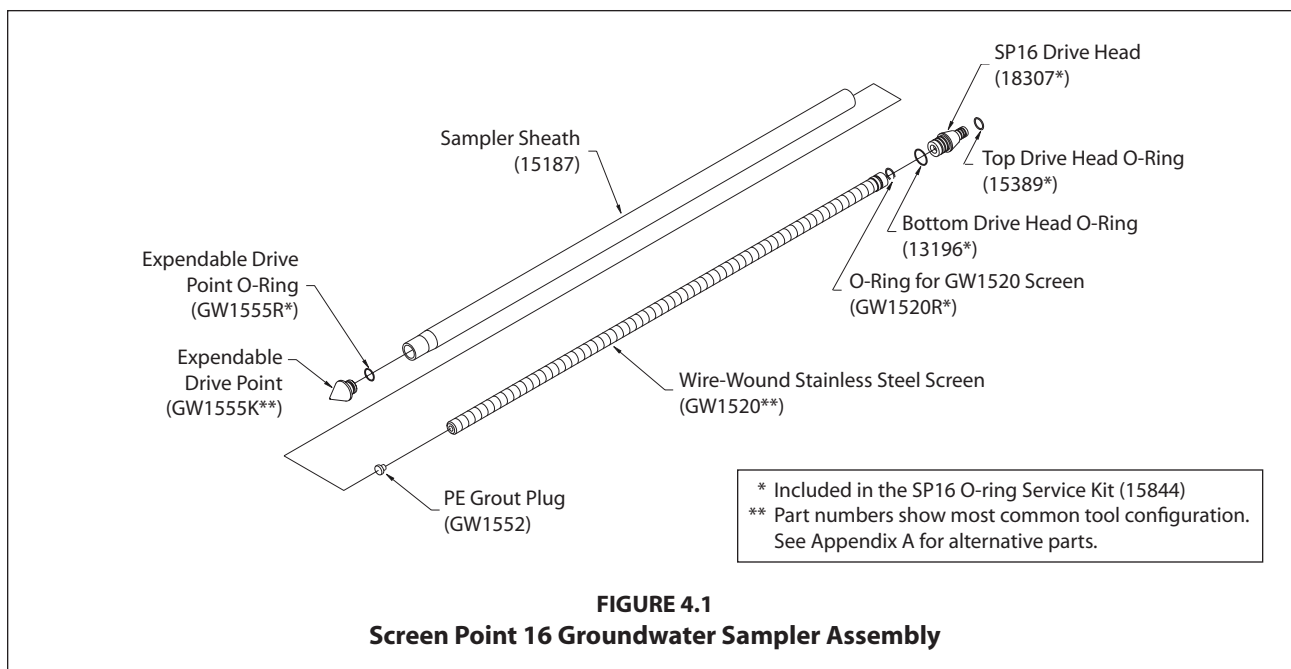
### 4.4 SP16 Sampler Assembly (Figure 4.1)

Part numbers are listed for a standard SP16 sampler using 1.5-inch probe rods. Refer to Page 6 for screen and drive head alternatives.

1. Place an O-ring on a steel expendable drive point (GW1555K). Firmly seat the expendable point in the necked end of a sampler sheath (15187).
2. Install a PE Grout Plug (GW1552) in the bottom end of a Wire-wound Stainless Steel Screen (GW1520). Place a GW1520R O-ring in the groove on the top end of the screen.
3. Slide the screen inside of the sampler sheath with the grout plug toward the bottom of the sampler. Ensure that the expendable point was not displaced by the screen.
4. Install a bottom O-ring (13196) on a Drive Head (18307 or 15188). Thread the drive head into the sampler sheath using an adjustable wrench if necessary to ensure complete engagement of the threads. Attach a Drive Cap (12787 or 15590) to the top of the drive head.

**NOTE:** The 18307 drive head should be used whenever possible as the smaller 0.5-inch ID provides a greater material cross-section for increased durability.

**Sampler assembly is complete.**

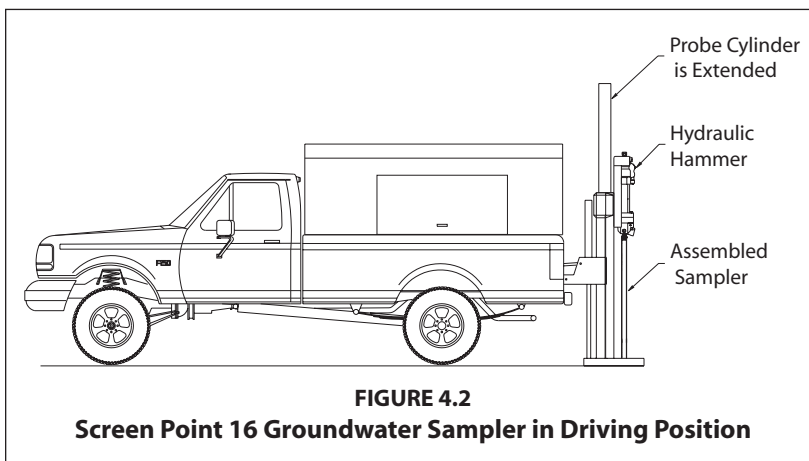


#### 4.5 Advancing the SP16 Sampler

To provide adequate room for screen deployment with the Rod Grip Pull System, the probe derrick should be extended a little over halfway out of the carrier vehicle when positioning for operation.

1. Begin by placing the assembled sampler (Fig. 2.1.A) in the driving position beneath the hydraulic hammer of the direct push machine as shown in Figure 4.2.
2. Advance the sampler with the throttle control at slow speed for the first few feet to ensure that the sampler is aligned properly. Switch to fast speed for the remainder of the probe stroke.
3. Completely raise the hammer assembly. Remove the drive cap and place an O-ring in the top groove of the drive head. Distilled water may be used to lubricate the O-ring if needed.

Add a probe rod (length to be determined by operator) and reattach the drive cap to the rod string. Drive the sampler the entire length of the new rod with the throttle control at fast speed.



4. Repeat Step 3 until the desired sampling interval is reached. Approximately 12 inches (305 mm) of the last probe rod must extend above the ground surface to allow attachment of the puller assembly. A 12-inch (305 mm) rod may be added if the tool string is over-driven.
5. Remove the drive cap and retract the probe derrick away from the tool string.

## 4.6 Screen Deployment

1. Thread a screen push adapter (GW1535) on an extension rod of suitable length (AT671, 10073, or AT675). Attach a threaded coupler (AT68) to the other end of the extension rod. Lower the extension rod inside of the probe rod taking care not to drop it down the tool string. An extension rod jig (AT690) may be used to hold the rods.
2. Add extension rods until the adapter contacts the bottom of the screen. To speed up this step, it is recommended that Extension Rod Quick Links (AT695 and AT696) are used at every other rod joint.
3. Ensure that at least 48 inches (1219 mm) of extension rod protrudes from the probe rod. Thread an extension rod handle (AT69) on the top extension rod.
4. Maneuver the probe assembly into position for pulling.
5. Raise (pull) the tool string while physically holding the screen in place with the extension rods (Fig. 4.3.B). A slight knock with the extension rod string will help to dislodge the expendable point and start the screen moving inside the sheath.

Raise the hammer and tool string about 44 inches (1118 cm) if using a GW1520 or GW1530 screen. At this point the screen head will contact the necked portion of the sampler sheath (Fig. 4.3.C.) and the extension rods will rise with the probe rods. Use care when deploying a PVC screen so as not to break the screen when it contacts the bottom of the sampler sheath.

The Disposable Screen (16089) will extend completely out of the sheath if the tool string is raised more than 45 inches (1143 mm). Measure and mark this distance on the top extension rod to avoid losing the screen during deployment.

6. Remove the rod grip handle, lower the hammer assembly, and retract the probe derrick. Remove the top extension rod (with handle) and top probe rod. Finally, extract all extension rods.
7. Groundwater samples can now be collected with a mini-bailer, peristaltic or vacuum pump, tubing bottom check valve assembly, bladder pump, or other acceptable small diameter sampling device.

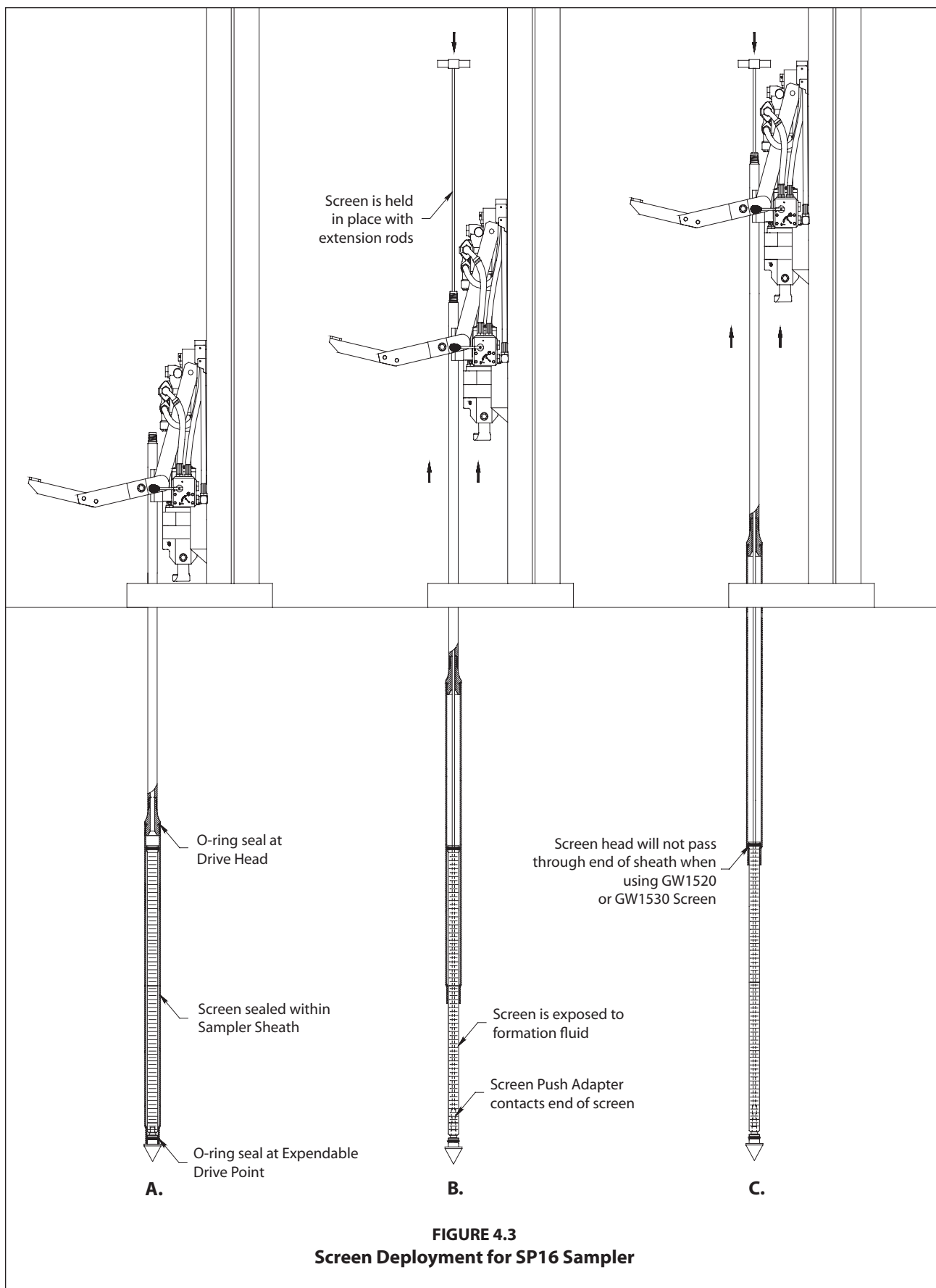
When inserting tubing or a bladder pump down the rod string, ensure that it enters the screen interval. The leading end of the tubing or bladder pump will sometimes catch at the screen head giving the illusion that the bottom of the screen has been reached. An up-and-down motion combined with rotation helps move the tubing or bladder pump past the lip and into the screen.

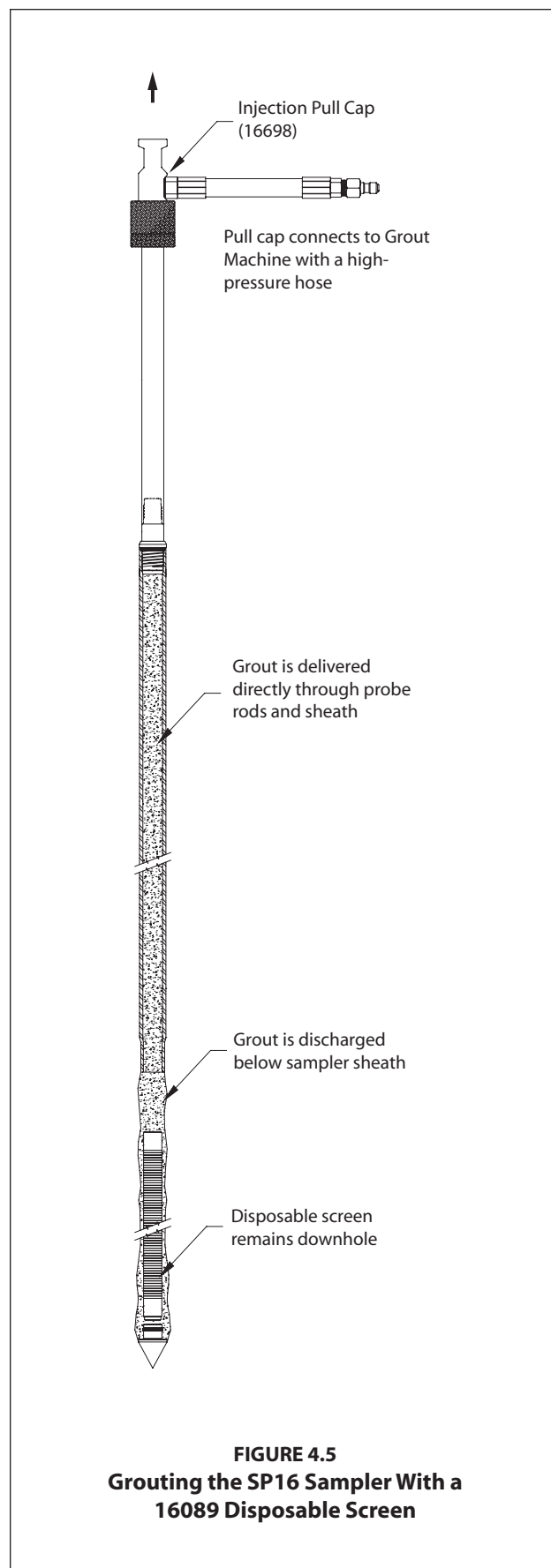
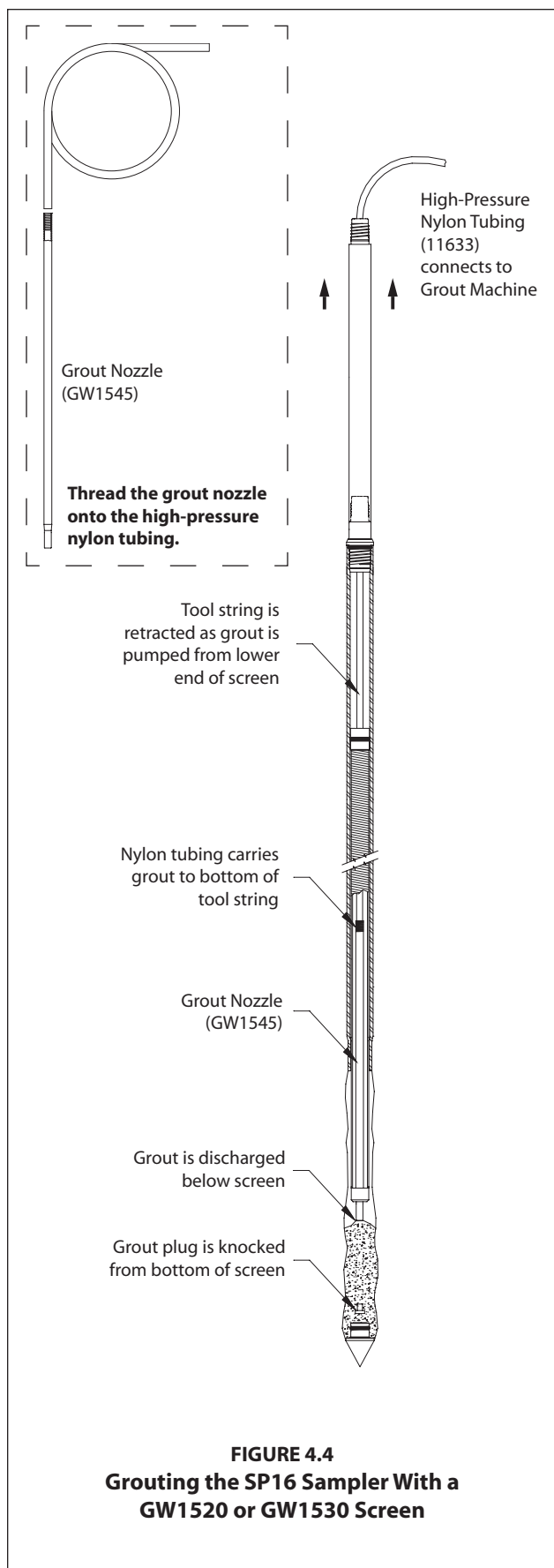
## 4.7 Abandonment Grouting for GW1520 and GW1530 Screens

The SP16 Sampler can meet ASTM D 5299 requirements for abandoning environmental wells or borings when grouting is conducted properly. A removable grout plug makes it possible to deploy tubing through the bottom of GW1520 and GW1530 screens. A GS500 or GS1000 Grout Machine is then used to pump grout into the open probe hole as the sampler is withdrawn. The following procedure is presented as an example only and should be modified to satisfy local abandonment grouting regulations.

1. Maneuver the probe assembly into position for pulling. Attach the rod grip puller to the top probe rod. Raise the tool string approximately 4 to 6 inches (102 to 152 cm) to allow removal of the grout plug.
2. Thread the Grout Plug Push Adapter (GW1540) onto an extension rod. Insert the adapter and extension rod inside the probe rod string. Add extension rods until the adapter contacts the grout plug at the bottom of the screen. Attach the handle to the top extension rod. When the extension rods are slightly raised and lowered, a relatively soft rebound should be felt as the adapter contacts the grout plug. This is especially true when using a PVC screen.







3. Place a mark on the extension rod even with the top of the probe rod. Apply downward pressure on the extension rods and push the grout plug out of the screen. The mark placed on the extension rod should now be below the top of the probe rod. Remove all extension rods.

**Note:** When working with a stainless steel screen, it may be necessary to raise and quickly lower the extension rods to jar the grout plug free. When the plug is successfully removed, a metal-on-metal sensation may be noted as the extension rods are gently "bounced" within the probe rods.

4. A Grout Nozzle (GW1545) is now connected to High-Pressure Nylon Tubing (11633) and inserted down through the probe rods to the bottom of the screen (Fig. 4.4). It may be necessary to pump a small amount of clean water through the tubing during deployment to jet out sediments that settled in the bottom of the screen. Resistance will sometimes be felt as the grout nozzle passes through the drive head. Rotate the tubing while moving it up-and-down to ensure that the nozzle has reached the bottom of the screen and is not hung up on the drive head.

**Note:** All probe rods remain strung on the tubing as the tool string is pulled. Provide extra tubing length to allow sufficient room to lay the rods on the ground as they are removed. An additional 20 feet is generally enough.

5. Operate the grout pump while pulling the first rod with the rod grip pull system. Coordinate pumping and pulling rates so that grout fills the void left by the sampler. After pulling the first rod, release the rod grip handle, fully lower the hammer, and regrip the tool string. Unthread the top probe and slide it over the tubing placing it on the ground near the end of the tubing.
6. Repeat Step 5 until the sampler is retrieved. Do not bend or kink the tubing when pulling and laying out the probe rods. Sharp bends create weak spots in the tubing which may burst when pumping grout. Remember to operate the grout pump only when pulling the rod string. The probe hole is thus filled with grout from the bottom up as the rods are extracted.
7. Promptly clean all probe rods and sampler parts before the grout sets up and clogs the equipment.

#### 4.8 Abandonment Grouting for the 16089 Disposable Screen

ASTM D 5299 requirements can also be met for the SP16 samplers when using the 16089 disposable screen. Because the screen remains downhole after sampling, the operator may choose either to deliver grout to the bottom of the tool string with nylon tubing or pump grout directly through the probe rods using an Injection Pull Cap (16698). A GS500 or GS1000 Grout Machine is needed to pump grout into the open probe hole as the sampler is withdrawn. The following procedure is presented as an example only and should be modified to satisfy local abandonment grouting regulations.

1. Maneuver the probe assembly into position for pulling with the rod grip puller.
2. Thread the screen push adapter onto an extension rod. Insert the adapter and extension rod inside the probe rod string. Add extension rods until the adapter contacts the bottom of the screen. Attach the handle to the top extension rod.
3. The disposable screen must be extended at least 46 inches (1168 mm) to clear the bottom of the sampler sheath. Considering the length of screen deployed in Section 4.7, determine the remaining distance required to fully extend the screen from the sheath. Mark this distance on the top extension rod.
4. Pull the tool string up to the mark on the top extension rod while holding the disposable screen in place.

The screen is now fully deployed and the sampler is ready for abandonment grouting. Apply grout to the bottom of the tool string during retrieval using either flexible tubing (as described in Section 4.7) or an injection pull cap (Fig. 4.5). This section continues with a description of grouting with a pull cap.

5. Remove the rod grip handle and maneuver the probe assembly directly over the tool string. Thread an Injection Pull Cap (16698) onto the top probe rod and close the hammer pull latch over the top of the pull cap.
6. Connect the pull cap to a Geoprobe® grout machine using a high-pressure grout hose.
7. Operate the pump to fill the entire tool string with grout. When a sufficient volume has been pumped to fill the tool string, begin pulling the rods and sampler while continuing to operate the grout pump. Considering the known pump volume and sampler cross-section, time tooling withdrawal to slightly "overpump" grout into the subsurface. This will ensure that all voids are filled during sampler retrieval.

The grouting process can lubricate the probe hole sufficiently to cause the tool string to slide back downhole when disconnected from the pull cap. Prevent this by withdrawing the tool string with the rod grip puller while maintaining a connection to the grout machine with the pull cap.

#### 4.9 Retrieving the Screen Point 16 Sampler

If grouting is not required, the Screen Point 16 Sampler can be retrieved by pulling the probe rods as with most other Geoprobe® applications. The Rod Grip Pull System should be used for this process as it allows the operator to remove rods without completely releasing the tool string. This avoids having the probe rods fall back downhole when released during the pulling procedure. A standard Pull Cap (15164) may still be used if preferred. Refer to the Owner's Manual for your Geoprobe® direct push machine for specific instructions on pulling the tool string.

### 5.0 REFERENCES

- American Society of Testing and Materials (ASTM), 2003. D6771-02 Standard Practice for Low-Flow Purging and Sampling for Wells and Devices Used for Ground-Water Quality Investigations. ASTM, West Conshohocken, PA. ([www.astm.org](http://www.astm.org))
- American Society of Testing and Materials (ASTM), 1993. ASTM 5299 *Standard Guide for Decommissioning of Groundwater Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities*. ASTM West Conshohocken, PA. ([www.astm.org](http://www.astm.org))
- Geoprobe Systems®, 2003, *Tools Catalog, V.6*.
- Geoprobe Systems®, 2006, *Model MB470 Mechanical Bladder Pump Standard Operating Procedure (SOP), Technical Bulletin No. MK3013*.
- Puls, Robert W., and Michael J. Barcelona, 1996. Ground Water Issue: Low-Flow (Minimal Drawdown) Ground Water Sampling Procedures. EPA/540/S-95/504. April.
- U.S. Environmental Protection Agency (EPA), 2003. Environmental Technology Verification Report: Geoprobe Inc., Mechanical Bladder Pump Model MB470. Office of Research and Development, Washington, D.C. EPA/600R-03/086. August.

## Appendix A ALTERNATIVE PARTS

The following parts are available to meet unique soil conditions. See section 3.0 for a complete listing of the common tool configurations for the Geoprobe® Screen Point 16 Groundwater Sampler.

<b>SP16 Sampler Parts and Accessories.....</b>	<b>Part Number</b>
SP16 Drive Head, 0.625-inch bore, 1.5-inch rods.....	15188
Expendable Drive Points, aluminum, 1.625-inch OD (Pkg. of 25).....	GW1555ALK
Expendable Drive Points, steel, 1.75-inch OD (Pkg. of 25).....	17066K
Screen, PVC, 10-Slot .....	GW1530
Screen, Disposable, PVC, 10-Slot .....	16089

<b>Groundwater Purging and Sampling Accessories .....</b>	<b>Part Number</b>
Polyethylene Tubing, 0.25-inch OD, 500 ft.....	TB17L
Polyethylene Tubing, 0.5-inch OD, 500 ft.....	TB37L
Polyethylene Tubing, 0.625-inch OD, 50 ft.....	TB50L
Check Valve Assembly, 0.25-inch OD Tubing.....	GW4240
Check Valve Assembly, 0.5-inch OD Tubing .....	GW4220
Check Valve Assembly, 0.625-inch OD Tubing .....	GW4230
Water Level Meter, 0.375-inch OD Probe, 100-ft. cable .....	GW2001
Water Level Meter, 0.438-inch OD Probe, 200-ft. cable .....	GW2002
Water Level Meter, 0.375-inch OD Probe, 200-ft. cable .....	GW2003
Water Level Meter, 0.438-inch OD Probe, 30-m cable .....	GW2005
Water Level Meter, 0.438-inch OD Probe, 60-m cable .....	GW2007
Water Level Meter, 0.375-inch OD Probe, 60-m cable .....	GE2008

<b>Grouting Accessories.....</b>	<b>Part Number</b>
Grout Machine, auxiliary-powered .....	GS500

<b>Probe Rods, Extension Rods, and Accessories .....</b>	<b>Part Number</b>
Probe Rod, 1.5-inch x 1-meter .....	17899
Probe Rod, 1.5-inch x 48-inch.....	13359
Drive Cap, 1.5-inch rods (for GH40 Series Hammer) .....	15590
Rod Grip Pull Handle, 1.5-inch Probe Rods (for GH40 Series Hammer) .....	GH1555
Extension Rod, 48-inch.....	AT671
Extension Rod, 1-meter .....	AT675

Equipment and tool specifications, including weights, dimensions, materials, and operating specifications included in this brochure are subject to change without notice. Where specifications are critical to your application, please consult Geoprobe Systems®.



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